IE 498 Homework 3

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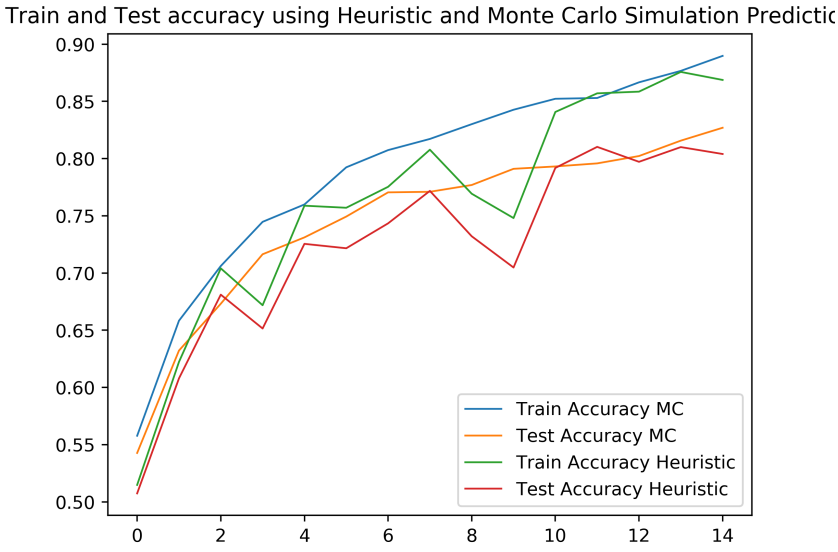
Result

A test accuracy of `82.3%` was reached using the following parameters in combination with monte carlo simulation. `80.4%` Was reached using the same parameters but with heuristic eval

Param	Value
Epochs	`15`
LR	`0.0005`
Optimizer	`ADAM`
Activation	`RELU`
Monte Carlo Iterations	`10`
Data Augmentation	Random vertical and/or horizontal flips



As observed from the plots above, the accuracies achieved for both the training and testing set increase more smoothly when applying the monte carlo simulation to the prediction. The heuristic rule is automatically used py pytorch when the model is in "eval-mode", whereas as the monte carlo simulation was implemented by running forward propagation a number of times during evaluation and using the average of the iterations as a basis for prediction. (see line 100-107 in the code).

Implementation

The architecture of the net is as follows in the code below. The convolutional blocks are named in accordance with their order and the linear block is the final one in the architecture. Each convolutional layer is followed by batch normalization and after each "pair" of convolutional layers max pooling and dropout is applied.

```
self.conv_block1 = nn.Sequential(
        nn.Conv2d(3, 32, kernel_size=3, padding=1),
        nn.BatchNorm2d(32),
        nn.ReLU(inplace=True),
        nn.Conv2d(32, 64, kernel_size=3, padding=1),
        nn.BatchNorm2d(64),
        nn.ReLU(inplace=True),
        nn.MaxPool2d(kernel_size=2,stride=2),
        nn.Dropout(0.05),
)

self.conv_block2 = nn.Sequential(
        nn.Conv2d(64, 128, kernel_size=5, padding=2),
        nn.BatchNorm2d(128),
        nn.ReLU(inplace=True),
        nn.Conv2d(128, 128, kernel_size=5, padding=2),
        nn.BatchNorm2d(128),
        nn.ReLU(inplace=True),
        nn.MaxPool2d(kernel_size=2,stride=2),
        nn.Dropout(0.05)
)

self.conv_block3 = nn.Sequential(
        nn.Conv2d(128, 256, kernel_size=5, padding=2),
        nn.BatchNorm2d(256),
        nn.ReLU(inplace=True),
        nn.Conv2d(256, 256, kernel_size=5, padding=2),
        nn.BatchNorm2d(256),
        nn.ReLU(inplace=True),
        nn.MaxPool2d(kernel_size=2,stride=2),
        nn.Dropout(0.1),
)

self.linear_block = nn.Sequential(
        nn.Linear(4096, 512),
        nn.ReLU(inplace=True),
        nn.Dropout(0.3),
        nn.Linear(512, 256),
        nn.ReLU(inplace=True),
        nn.Linear(256, 10),
)
```

The architecture is based on that of the network provided as an example in class. The changes made are increased filter size and number of channels in the convolutional layers. A higher probability for dropout in the later (linear) layers was also added in order to combat overfitting that was previously observed.

Instructions & requirements

```
# Run the code:

python net.py
```

Requires python 3.6 or above due to f-string formatting.